M314-EP

PATENT SPECIFICATION

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(21) Application No. 45665/75 (22) Filed 3 Nov. 1975
(31) Convention Application No. 2 454 232
(32) Filed 15 Nov. 1974 in
(33) Fed. Rep. of Germany (DE)
(44) Complete Specification published 5 April 1978
(51) INT CL² H04N 1/40//H03K 13/175
(52) Index at acceptance
H4F S30B S30H S30K
H4P A8B A8Y B1 C5 E2 G1 H4 M3 M5
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(19)

(54) TRANSMITTING VIDEO SIGNALS

(71) We, ROBERT BOSCH GMBH, of Robert-Bosch-Strasse 7, 6100 Darmstadt, Federal Republic of Germany, a German company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to a system for transmitting and receiving video signals by the difference signal technique, wherein prior to transmission the difference signals are coded in a quantizer having a controllable quantization characteristic.

In the digital transmission of television signals various methods are known of reducing the bandwidth of the channel required for the transmission. For example, in the coding of the signals attempts are made to use as few quantization stages or levels as possible, but the result of this, in the case of image surfaces whose brightness is gradually changing, is to produce disturbing contour phenomena in the reproduced picture. In the so-called difference signal method, for example in DPCM transmission, transmission is effected, in respect of each sampling point of the signal, of the difference value as compared with the preceding sampling point. In the case of laminar or surface portions of the image the difference signals are relatively small so that they can be transmitted with a few closely adjacent quantization steps or levels. However, in the case of edges the difference signal is very large, but in this case it is not required to carry out an exact graduation. For this reason a known system proposes to select the quantization characteristic of the quantizer according to the presence or the absence of edges.

If, however, the video signal to be coded is accompanied by noise, then it may occur that this noise causes a statistical alternation of the signal between values above or below the threshold for determining the presence of an edge. As a result unwanted switching or jittering between the quantization characteristics may occur and additional noise will appear in the reproduced picture.

It is the purpose of the invention to provide a system in which this additional noise is substantially reduced.

According to the invention there is provided a system for transmitting and receiving a video signal, wherein prior to transmission the video signal is sampled at regular intervals and difference signals each corresponding to the difference between a respective sampled value of the video signal and the preceding sampled value are coded in a quantizer which automatically changes, for a predetermined period of time, from using a first quantization characteristic to using a second quantization characteristic in response to the difference signal exceeding a predetermined threshold level, the two quantization characteristics having a common level, equal to the predetermined threshold level, at which the quantizer output changes from one value to another value, and wherein after transmission the transmitted signals are decoded, the two decoded difference signals corresponding to respective difference signals which, prior to coding and transmission, lay immediately above and below the threshold level having the same two values in respect of both quantization characteristics.

This system has the advantage that, in the case of signal values lying in the region of the predetermined threshold level, the noise results in no additional degrading of the signal to noise ratio.

An embodiment of the invention will now be described with reference to the accompanying drawings, in which:

Fig. 1 shows a quantizer forming part of the transmission side of a system according to the invention; and

Fig. 2 shows the quantization and decoding characteristics of the system.

Difference signals, which correspond in each case to the difference between the instantaneous and preceding sampled values of the video signal, are delivered at the point

11 to the quantizer of Fig. 1. The means for forming the difference signals, by scanning or sampling the video signal at regular intervals and forming the difference between each sampled value and the preceding sampled value, are well known in the art and do not need to be described here. The difference signals can be either in analog form or in digital form; in the latter case, however, they should each comprise a large number of binary places, usually eight. The difference signals are delivered to comparators 12, 13, 14, 15 which may be of known type. In the case of analog difference signals these comparators will each comprise a difference amplifier. In either case, whether the comparison is analog or digital, there is delivered to the other input of each comparator a respective reference voltage applicable to the quantization characteristic which is being employed. Switching from one quantization characteristic to the other is effected by the mechanically coupled switches 16, 17 and 18. It is assumed that the switches 16, 17, 18 when in their upper position deliver reference voltages to the comparators corresponding to a coarse quantization characteristic appropriate to edges, and in their lower position deliver reference voltages corresponding to a finely stepped quantization characteristic appropriate to surfaces. The reference voltages are indicated as percentages of the maximum amplitude of the different signal. Each comparator delivers an output signal at a first level when its reference voltage is exceeded and at a second level when its reference voltage is not exceeded.

To the comparator 15 there is delivered a constant reference voltage common to both characteristics, amounting for example to 15% of the maximum amplitude of the difference signal. At this level the quantizer output (at 31) changes from one value to another value irrespective of which quantizer characteristic is being used.

The output signal of the comparator 15 is delivered to an edge detector 30. It is to be understood that the switches 16 to 18 are normally in their lower position, suitable for the coding of difference signals corresponding to surfaces. The detector 30, however, produces a control voltage on the appearance of an edge, which in the present case is assumed to be indicated by the appearance of a difference signal greater than 15%, which control voltage brings the switches into the upper position for a predetermined period of time. An example of an edge detector is disclosed in our U.K. Patent Specification No. 1 471 899; see components 20 to 30 inclusive of Figure 2 of this prior specification. In this case the control voltage brings the switches into the upper position for five successive picture points in the line following that in which the edge (i.e. a difference signal greater than 15%) is detected.

The digital output signals of the comparators 12, 13, 14 and 15 are delivered to a coder 31 which in known manner converts the information into a form suitable for transmission.

As previously mentioned, the two quantization characteristics have a common quantization level (15%) which is equal to the threshold level determining the choice of characteristic in 30. As shown in Fig. 2, in the decoding process, which is accomplished upon reception of the transmitted signals by a known type of decoder (not shown), it is arranged that the two decoded difference signals corresponding to respective input difference signals which, prior to coding and transmission, lay immediately above and below this 15% threshold level also have the same two values for both of the quantization characteristics, the result of which is that any unwanted reversal from one characteristic to the other caused by noise effects cannot have a disturbing effect upon the reproduced picture.

In Fig. 2 the coarse quantization characteristic provided for transmitting edges is indicated by dotted lines and the fine quantization characteristics employed for transmitting surfaces is shown in full lines. Both the decoded difference signal output voltage of the system after transmission (vertical axis) as well as the difference signal input voltage to the comparators (horizontal axis) are plotted in percentages of their maximum values. Common to both of the characteristics is a quantization level equal to the characteristic-switching threshold at 15% of the maximum input voltage as well as the adjacent decoded output voltages, namely those at 10% and 20%.

WHAT WE CLAIM IS:—

1. A system for transmitting and receiving a video signal, wherein prior to transmission the video signal is sampled at regular intervals and difference signals each corresponding to the difference between a respective sampled value of the video signal and the preceding sampled value are coded in a quantizer which automatically changes, for a predetermined period of time, from using a first quantization characteristic to using a second quantization characteristic in response to the difference signal exceeding a predetermined threshold level, the two quantization characteristics having a common level, equal to the predetermined threshold level, at which the quantizer output changes from one value to another value, and wherein after transmission the transmitted signals are decoded, the two de-

coded difference signals corresponding to respective difference signals wnich, prior to coding and transmission, lay immediately above and below the threshold level having the same two values in respect of both quantization characteristics.

2. A system as claimed in claim 1, wherein the predetermined threshold level is 15% of the maximum value of the difference signal.

3. A system as claimed in claim 2, wherein the two decoded difference signal levels adjacent the threshold level are 10% and 20% respectively of the maximum value of the decoded difference signal.

4. A system for transmitting and receiving a video signal, substantially as described with reference to the accompanying drawings.

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Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1978.
Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.

1506530 COMPLETE SPECIFICATION
1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

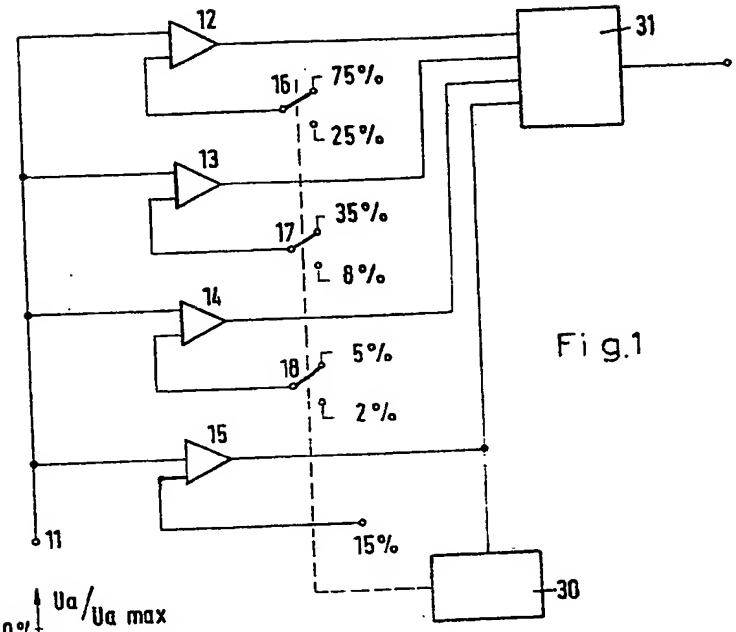

Fig.1

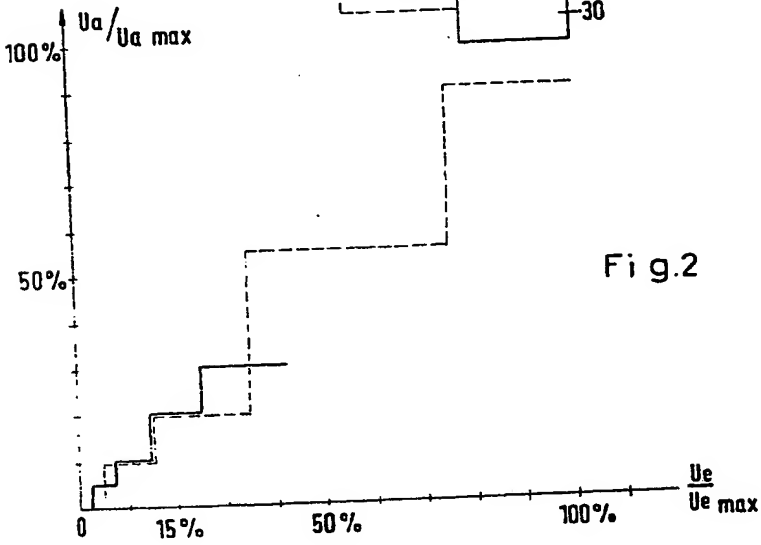

Fig.2